



National Renewable Energy Laboratory

# NREL International Program Overview

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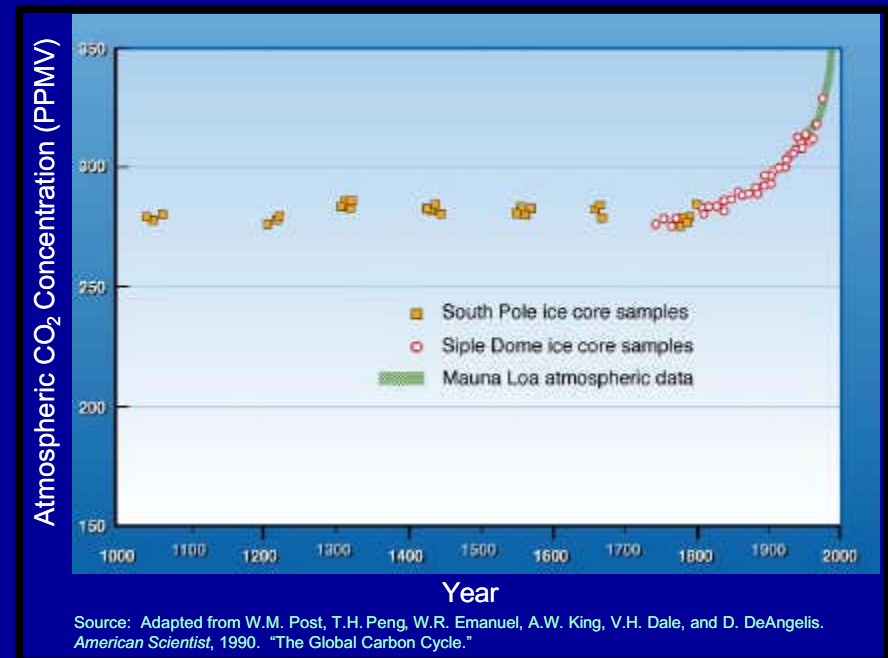
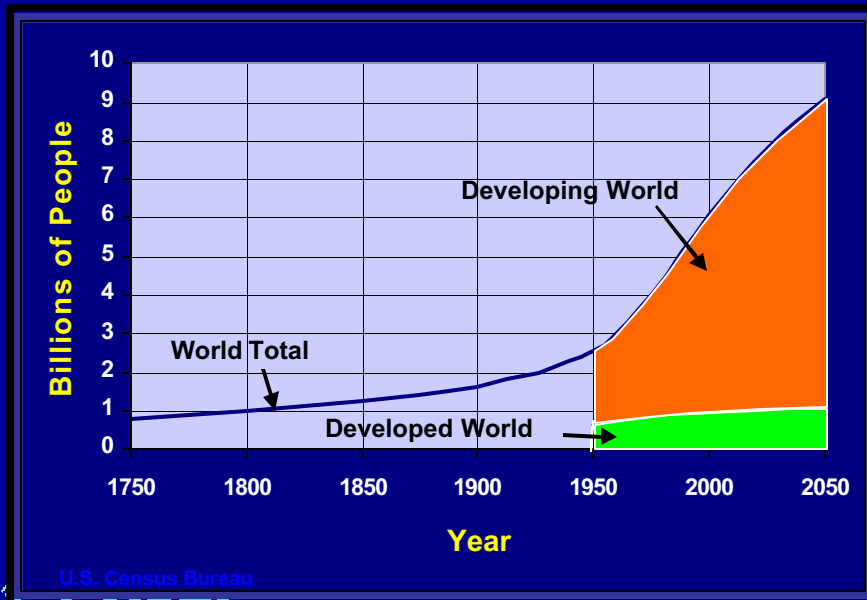
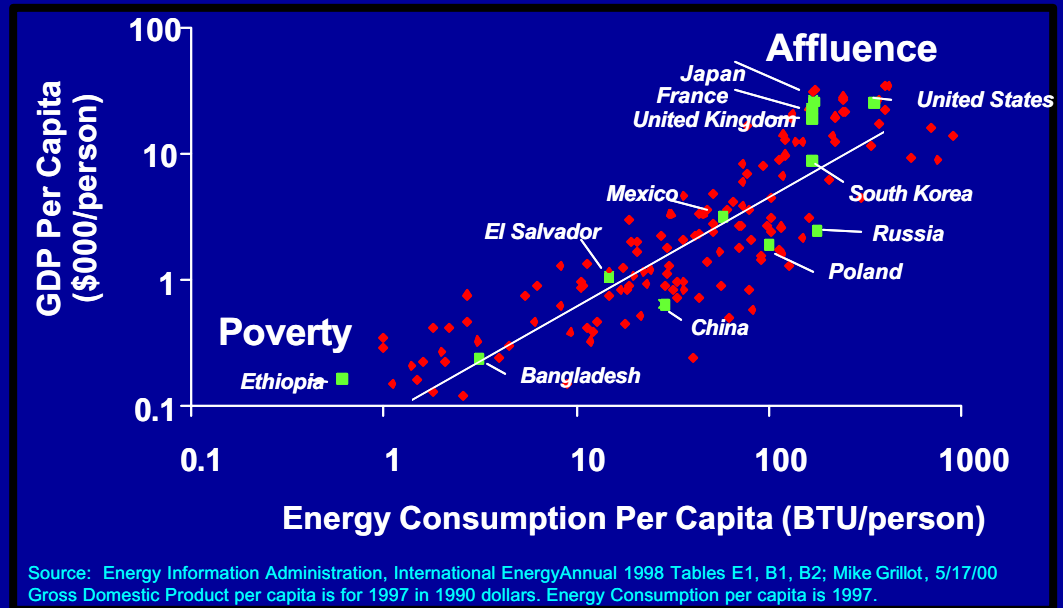


# The Challenge of International Clean & Renewable Energy Activities

- Currently 6 billion people on the planet
- 1.2 billion living in developed (OECD) countries
- 4.8 billion, 80%, in developing countries
  - Three billion of them live on under \$2 a day
  - Two billion of them live in rural areas
  - Two billion of them don't have modern energy services
- 6 billion today, will grow to 8 billion people in 25 years  
& 97 percent of the growth will be in the developing world



# World Development Needs Clean Energy



# **The Context – Late 1990's**

**Four strategic goals:**

- 1) Addressing Emerging Global Environmental & Energy Issues**
- 2) Promoting Trade & Market Development**
- 3) Promoting Energy & Environmental Security**
- 4) Conducting Cooperative R&D**



# The Context – Current

- **Energy Security** (reduce oil demand growth by displacement of in-country oil consumption with renewables and improved energy efficiencies)
- **Opening International Markets for the U.S. EERE Industry** (in-country policy support and strategic planning)
- **Deployment of EERE Technologies Abroad** (CETE initiative, GVEP and other WSSD initiatives, collaboration with UNEP and UNDP, and related bilateral programs)
- **International S&T Cooperation** (on RE technology development and deployment, including work on climate technology cooperation through the Climate Technology Initiative)



# Laboratory Context

- Perform international projects & activities to support EERE's mission & goals.
- Conduct work sponsored by other government & private organizations with complementary missions & objectives.
- Sponsor some complementary activities with internal resources.



# The Reality

- **Modest impact** because of: 1) enormity of global challenge, and 2) relatively modest resources.
- **Establishing self-sustaining EE/RE markets & businesses** is a requirement to fully realize goals.
- **Comprehensive policy, market, & technology focus in specific geo-political regions** is required to create self-sustaining markets & businesses.
- Comprehensive treatment requires close collaboration with many strategic partners sharing common objectives & broad resources.
- The “market” is looking for low cost energy services, not technology.



## Goals & Objectives

## Strategic Partners

## Activities





# The Strategic Objective

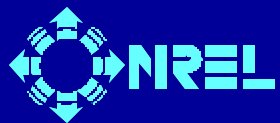
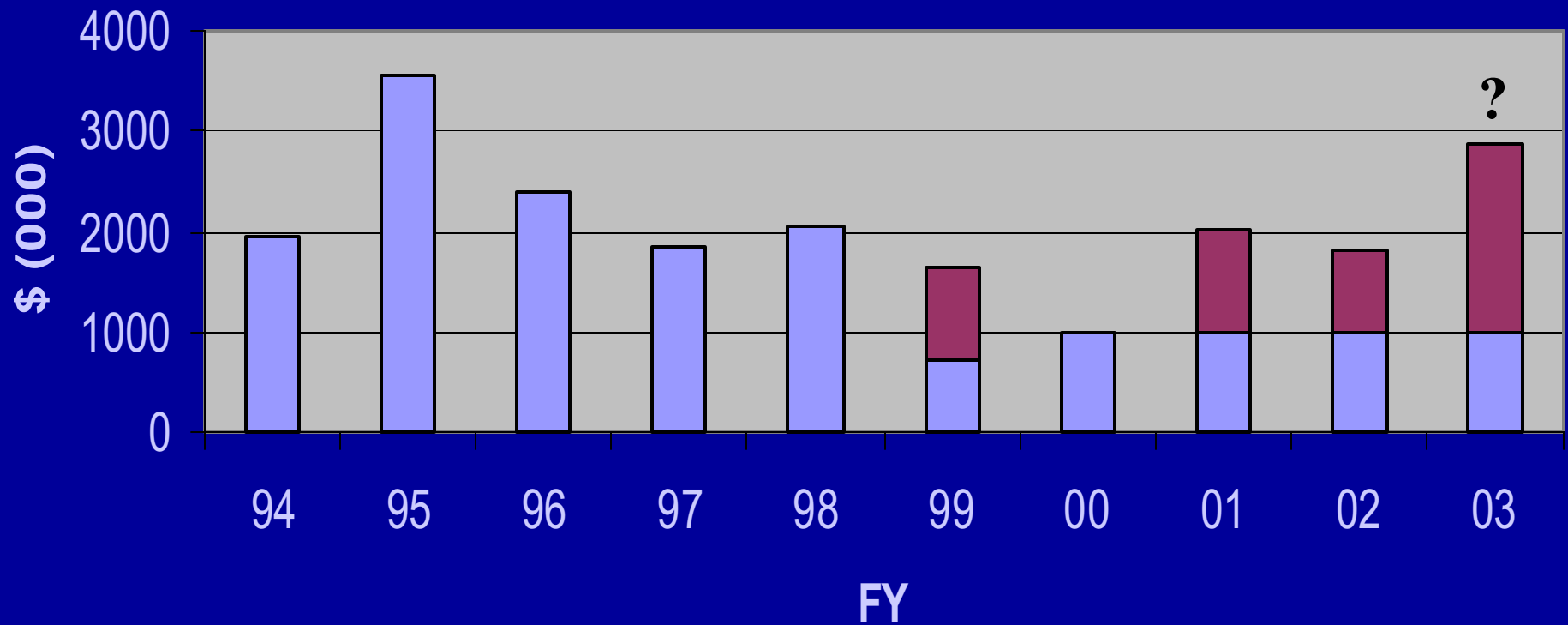
*To accelerate the establishment of self-sustaining EE/RE markets and businesses in developing and transition countries.*

Anything less will fail to achieve our strategic goals



## DOE RE Intn'l Funding @ NREL

Other DOE DOE-Intn'l



Does not include WFO or OH \$

# Two Different RE Worlds

- **Grid-connected World** (focus on low  $\text{¢/kWh}$ )
  - Competition between renewables & conventional options
  - Competition and complementarity among renewable options
- **Off-grid, Rural Electrification World** (focus on provision of basic energy services)
  - Small-Scale Individual DC Systems for Specific Loads
    - 12-48V PV and/or Wind Battery Charging Systems
  - Hybrid AC Power Systems for Village Mini-grids
    - Wind, PV, Biomass,  $\mu$ -Hydro, Battery, Gen-sets
    - Mini-grids, Micro-Enterprise Zones, Motor Loads



# **NREL International Renewable Energy Program**

## **Draft Annual Operating Plan**

### Fiscal Year 2003 EERE Funding

#### **Energy Security**

#### **Opening Markets and Deployment of EERE Tech. Abroad**

- **Asia:** China, India
- **Africa:** Egypt, Ghana, Morocco, Algeria, Nigeria, Southern Africa
- **Latin America:** Argentina, Chile, Bolivia, Brazil, Mexico

#### **Supporting Activities**

- **Global Village Energy Partnership**
- **Clean Energy Technology Export Initiative Support**
- **Climate Technology Initiative**
- **S&T Agreements**
- **Project Analysis Tools**
- **RE Training Materials and Courses**
- **UNEP Collaborating Center & SWERA Project**

#### **Industry VP Applications Development (Funding Permitting)**



# Energy Security

**Afghanistan:** If and when, no new resources, waiting for “call to action”

## **Jordan Water Desalination Project:**

- \$850K AID-MERC(\$500K)/DOE(\$350K) cost-shared effort (Israel, Jordan, PWA) underway
- Progress slow due to current tensions in the region

## **North American Energy Working Group:**

- Extending CA, AZ, NM high resolution wind RA 200km into Mexico
- Wind farm opportunity assessment to follow
- No new resources needed (until it's time to pick up Texas border region)

## **Reduced Oil Demand Growth:**

- Assessment of the international diesel-for-power generation base underway
- Assessment of the international ethanol market as a transportation fuel alternative underway

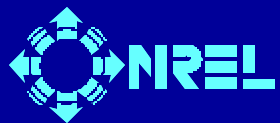


# Opening Markets & Deployment of EERE Technologies Abroad

Asia

Africa

Latin America



# Asia

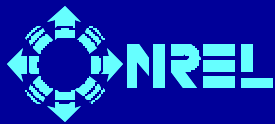
- US-China Bi-Lateral Agreement
  - US-India MOU Support
    - APEC Support
    - Philippines (AID)
- Sri Lanka, Maldives, SARI (AID)



# US/China Renewable Energy Cooperation

## The US/China Protocol for EERE

- Signed 1995; Led by US DOE and Chinese Ministry of Science and Technology (MOST); Implemented by NREL with Chinese partners
- Five Renewable Energy Annexes
  - Rural Energy Development – Ministry of Agriculture
  - Wind Development – State Power Corporation
  - Renewable Energy Business Development – State Economic and Trade Commission (SETC)
  - Geothermal Heat Pumps – MOST
  - Renewable Energy Policy and Planning – State Development Planning Commission (SDPC)





# Pilot Projects



Inner Mongolia Wind/PV hybrid systems  
402 homes installed  
Leveraged 50,000-60,000 systems in province



Great Wall PV demonstration and education site



DOE/APEC - 200 solar home systems; 2 PV villages in Tibet



Gansu Solar Home Systems  
780 homes, 10 schools  
Leveraged 10,000 MOA systems

Tibet amorphous silicon PV demonstration for Township Program

# Rural Electrification

- SDPC Brightness Program/Township Electrification Program
  - \$240M SDPC grant for 17 MW PV and wind village power systems; 800 townships in 2002-2003
  - SDPC to supply remaining 20,000 unconnected villages in next phases
  - Training certification framework for SHS, village power and hybrid systems:
    - Certified 4 master trainers for SHS (7/02)
    - Prepare village power training manual (1/03)
    - Technical training workshop (1/03) – train technicians on village power system installation, O&M, repair
    - Accredit auditors and training centers (1/03)
  - Village power sustainability workshop (12/02) – design program guidelines for tariffs, O&M, productive uses
  - Monitor 2 village systems to improve technical and economic performance – software and training on system design, optimization modeling
  - Rural household energy surveys in Xinjiang, Qinghai and Inner Mongolia and analysis of least-cost systems options
- Tibetan village PV installation to demonstrate amorphous silicon technology



# Renewable Energy Business Development

- Business and Market Studies
  - Provincial renewable business profiles - *Renewable Energy Markets In China: An Analysis of Renewable Energy Markets in Guangdong, Jiangxi, Jilin and Yunnan, with Updated Information from Beijing*
  - Chinese PV industry and technology assessments - *PV Business Application and Evaluation*
  - Review of status of PV technology and industry development in China - *Commercialization of Solar PV Systems in China*
- Business Partnership Facilitation
  - CREIA provides in-country liaison assistance for US companies
- RE Business Development Workshops and Study Tours
  - 1998 Beijing, Inner Mongolia
  - 1999 Xi'an, Gansu, Xinjiang
  - 2001 Chengdu, Yunnan, Inner Mongolia



# Renewable Energy Policy and Training

- 1998 policy study comparing US and Chinese renewable energy policies. Led to SDPC advocating initiatives to the State Council including Renewables Portfolio Standard, reductions in value-added tax for renewables, and establishment of a special fund for renewables.
- Assisting Hunan and Xinjiang planning commissions prepare renewable energy plans with use of the LEAP model to analyze renewable energy potential, targets and policies.
- HOMER/VIPOR training (7/02) – RE system design and optimization modeling training for 20 system integrators
- Training on LEAP software (7/02)
- Four Chinese delegates trained at the Solar Energy International (3/02)
- Training at NREL on life cycle assessment and GIS analysis (6/98, 6/99)



# Potential Renewable Energy Cooperation for the Beijing Olympics

- Green Buildings and Green Olympic facilities using EERE technologies including geothermal heat pumps, building-integrated PV, daylighting, roof-integrated solar water heaters, etc.
- Training and technical assistance in design, siting, installation, O&M of renewable energy systems.



# India – FY02 Activities

## CTIP India Launched

- Scoping meeting held with CTI, Government of India officials and other Indian partners to discuss EERE technology priorities and identify potential project opportunities.
- Partners for proposed projects identified and project plans developed.

## Village Power India

- Preliminary site assessment conducted for hybrid power retrofit on Elephanta Island in bay of Bombay, 80kW load. Good, access, visibility, and training opportunity. Questionable wind energy resource. Measurements underway.



# India – Proposed FY03 Activities

## CTIP India

**Municipal ESCO Development** -- Provide assistance in creating a network of energy service companies (ESCOs) to assist Indian municipalities in identifying and implementing energy savings programs. Activities to include training, energy audits, project definition, and financing identification.

**Small Hydropower and Water Pumping Development in Uttaranchal Pradesh** -- Collaborate with US Hydropower Council for International Development and the state government of Uttaranchal Pradesh in identifying and addressing the barriers in state policy that are preventing small hydropower projects from being implemented.

## Village Power India

**Elephanta Island Hybrid Power Project** Project evaluation and implementation recommendation report – wind data currently being collected at the site for further evaluation. Project procurement definition. Support project hardware solicitation, procurement and installation assuming acceptable funding and cost sharing arrangements (funding not included).

**Advanced training activities with the RKM** in West Bengal and provide real-time data collection link between the NREL small-systems test facility and the MNES Solar Energy Center.



# APEC

- Better integration of regional APEC activities with targeted country programs
- APEC Conference in Baltimore, MD in Sept. 03





# Philippines

Broad 2-year program funded by AID-Manila included work in the following areas:

## **Resource Assessment**

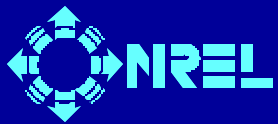
**Policy** (utility restructuring)

## **Barangay Electrification Program**

- Strategic Planning
- Diesel Retrofit Options Analysis

## **US Industry Support**

- Initiated introduction of CPC-Shell RESCO into Palawan
- Renewable energy for agriculture – WorldWater (established Philippines subsidiary)
- Wind-Diesel hybrids (including 14 SPUG sites) – BreezElectric
- Hydropower – US Hydropower Council working with P-DOE Mini-hydro Division



# SARI-E

New funding from AID – SARI-E and EGAT is providing for development of solar and wind resource assessments in Sri Lanka and the Maldives.



# South America

- Chile
- Argentina
- Mexico
- Bolivia
- Brazil
- GVEP-LAC Conference



# Chile – FY02 Activities

## **Islands Replication Program Including Isla Tac Pilot Project**

- Supported Chilean plans to electrify 32 islands in Chiloe region using renewable power systems.
- Support for the pilot system on Isla Tac and incorporation in the replication project design.

## **Assistance to CNE in Rural Electrification Replication**

- Technical assistance specifically relating to rural schools and health posts.

## **Technical assistance – Archipelago of Juan Fernandez**

- Island community of San Juan Bautista (Juan Fernandez, 300 km off the Chilean coast) powered by a small diesel power system, with fuel delivery from the Chilean mainland 4 times a year.
- State and federal governments are interested in wind/diesel hybrid to reduce fuel use.
- Assistance in resource monitoring, siting and system analysis and initial options design to CNE

## **Continued Support for Universidad de Magallanes**

- Assistance to the University to become a regional center of excellence. Through this work the University has become internationally recognized in this field, bringing more support from regional and federal authorities.

## **Capacity Building**

- Support the Chilean government through capacity building activities and RE information



# Chile – Proposed FY03 Activities

**Isla Tac Project Support and Socio-Economic Study** Two years of successful operation of the hybrid power project on the island of Tac in the Chiloe Sound have provided great insight what will support further rural electrification projects.

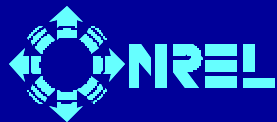
- Funds will be used to support the system and conduct a study to provide insights and guidance into local economic development and project sustainability.

**Assistance to CNE in Rural Electrification Replication** Chile is undertaking more programs similar to the Islands Replication Program. It is important (from a technical standpoint) to provide assistance in new programs (such as rural schools electrification) to help assure success. Provide technical support to CNE in these activities.

**Technical Assistance – Archipelago of Juan Fernandez** As this project nears implementation, provide assistance in the development and review of an international RFP for system development and installation. Provide technical assistance to measure, quantify and document the environmental benefits of this project.

**Continued Support for Univeridad de Magalanes** Support further development in system analysis, complete system design, support for hybrid technology, research activities, core curriculum development, cooperative training, and regional project development.

**Capacity Building of Decision Makers** Support the continued capacity building of governmental planners, utilities, and system implementers in the area of RE based power systems for rural areas. In cooperation with Univeridad de Magallanes and CNE, conduct two workshops and US-based training on hybrid system design and implementation.



# Argentina – FY02 Activities

## **Technical assistance to Servicio Publico Santa Cruse (SPSC)**

The regional power company for the province of Santa Cruse operates many remote diesel stations, most of which also have good wind resources. Work has been ongoing to support SPSC in the use of wind energy, specifically through the implementation of a wind diesel pilot project in cooperation with TDX and Kotzebue Electric (Alaska), Northern Power Systems and Atlantic Orient Company (Vermont).

## **Diesel Retrofit Pilot Project Support for the Tres Lagos**

Due to the economic conditions in Argentina, the wind diesel retrofit project for the community of Tres Lagos was put on hold. To make use of the turbine it will be installed in the community of El Calafate.

- Site selection and monitoring
- Installation design and plan development
- Training
- Retrofit of wind turbine controller at NREL
- Implementation of remote monitoring and DAS system.



# Argentina – Proposed FY03 Activities

## **Diesel Retrofit Pilot Project Support for the El Calafate Power system**

Provide technical assistance to the local utility for the installation and operation of the AOC wind turbine now being installed at El Calafate.

## **Training support for Wind Power Development**

Support the participation of at least two engineers to attend training in the US. This work would include activities at NREL and could include attendance at workshops such as WEATS or the USDOE/AWEA/CanWEA Wind Diesel Workshop.



# Mexico – FY02 Activities

## ESCO pilot program

- 2 projects in final negotiation: 1 industrial project in Monterrey developed by a partnership (Mexican ESCO, US consulting firm, and international investment firm); and 1 hotel project developed by a Mexican ESCO
- 7 events and 29 site visits has developed direct contact with over 80 energy end-users, 30 have noted strong interest in knowing the benefits of the ESCO scheme and in assessing potential projects.
- Distribution of 9 project briefs to international and Mexican ESCOs through NAESCO, ESC and CONAE distribution channels
- Publication in NAESCO Energy Efficiency Journal, and information on website
- A Guide for the development of ESCO projects, available on CONAE's web page, was developed and distributed to over 20 Mexican ESCOs and over 80 energy end-users.
- A Guide for performance contracting is currently under development

## Resource Mapping

- Initiated wind mapping activities along US/Mexico border, Pacific coast to Texas border
- Secured resources from AID to develop wind atlas for State of Oaxaca.

## Technical support of existing hybrid power systems.

- Continued providing support for five hybrid power systems in operation in the Yucatan and Baja California provinces installed with support by USDOE and USAID





# Mexico – Proposed FY03 Activities

**Expand the ESCO pilot program** Building on current ESCO work in the hotel and the industrial sectors, include a broader team of international technical experts and more technical assistance and training. Collaborate with ICF, LBL, NAESCO, the NREL FEMP program, and a broader team of Mexican technical experts, including FIDE and ATPAE, and the public sector. Focus on the development of 2-4 projects within 1 municipality, including industrial facilities, hospitals and other public buildings.

**Technical support of existing hybrid power systems.** Continued support for five hybrid power systems in operation in the Yucatan and Baja California provinces installed with support by USDOE and USAID (work not covered by funds from Sandia). This work allows continued contact with authorities and hybrid system operators in the regions.

**Investigation of Border-Region Wind Potential .** Conduct a study of large scale wind development opportunities in Mexico along the U.S.-Mexico border region.

**Implementation Assistance in Border-Region Wind** Conduct a series of workshops to provide guidance in the implementation of border-region wind energy development covering both in the large and small wind market sectors. Large wind work will be conducted in collaboration with Wind Powering America. Small wind implementation work will be conducted in collaboration with the US equipment suppliers and local organizations.

**Continued Resource Mapping** Work with IIE and other Mexican partners to identify other high-priority areas that need to be supported by accurate resource maps, and identify other funding partners.

**Green Energy Marketing** Based on U.S. experience in Green Power Marketing, collaborate with CONAE and the SE to promote the development of a full range of regulatory and pricing incentive programs such as RE portfolio standards, system benefit charges, development of PPAs for wind power development, green power voluntary programs, green pricing, development of wind concessions, and other opportunities.



# Bolivia – FY02 Activities

DOE supported activities and accomplishments in Bolivia under the Climate Technology Initiative in FY02 include:

- Technical review of the technology needs assessment carried out by the Bolivian Government with financial assistance from the GEF;
- Jointly sponsored GOB/CTI workshop in La Paz, Bolivia to engage key stakeholders from government, private sector and donor community in effort to focus technology needs assessment work on specific technology areas;
- Bolivia presented results at UNFCCC technology transfer workshops and CTI event at SBSTA meetings where their country work has become a model for others undertaking technology needs assessments; and,
- Identification by Bolivian counterparts of priority technology areas based on needs assessment and U.S. supported workshop in April.
- Under a non-CTI related effort, NREL has also coordinated the GHG mitigation analysis work in Bolivia using the Markal-Macro model in conjunction with Brookhaven National Lab.



# Bolivia – Proposed FY03 Activities

## CTI Technical Assistance for Project Implementation

Assistance in FY03 will support the implementation of actions to promote project development in 1-2 of the high priority technology areas identified by the Bolivian government. The initial priorities identified by Bolivia under their technology needs assessment include:

- Small-scale renewable energy for rural applications;
- Improvement of processes and engineering, including fuel switching for rural industries such as cement and sugar production;
- Fuel technologies (CNG, LPG) in the transport sector; and,
- Combined cycle and co-generation in electricity generation.

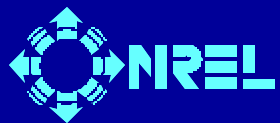


# Brazil – FY02 Activities

## Early NREL Hybrid System Assessment

In the 1994-1997 timeframe, NREL worked with the Center for Electric Power Research (CEPEL) and the state utilities in Amazonas and Para to install two 50kW hybrid power systems.

At the end of FY02 NREL personnel will accompany Northern Power Systems, Winrock, the Center for Electric Power Research (CEPEL) and local utility personnel to review the two power systems, making an assessment of their current conditions and to discuss options for their revitalization, either in the region or elsewhere.



# Brazil – Proposed FY03 Activities

## Diesel Offset Strategy for Amazonia Brazil

### Creation of Diesel Offset “Opportunity Map”

- Work with local counterparts to catalogue existing and planned diesel facilities in the Amazon region.
- As SWERA project information becomes available, work with Brazilian counterparts to identify likely communities that have access to renewable energy resources that can be harnessed to reduce local dependence on diesel fuel imports.

### Project Identification and Technical Assistance

- Work with US and local organizations to identify the most promising sites for renewable energy development and initiate preliminary options/feasibility analysis at selected sites, including assistance to industry partners and facilitating financing opportunities.



# **GVEP – LAC Conference**

**Support the GVEP – LAC Conference to be held in  
Santa Cruz, Bolivia – June, 2003**



# Africa

- Morocco
  - Algeria
  - Jordan
  - Ghana
  - Egypt
- Southern Africa Region
- (Nigeria, Mozambique)



# Morocco

## FY02 Activities

**Strategic Planning** Assisted Morocco in developing a national EERE strategic plan

- Rural electrification
- Large scale wind power development
- EE and solar water heating
- Regulatory and policy reform

**Technical Assistance** – ISP Accreditation of CDER

## FY03 Activities

RE annex signed by Secretary Abraham during the African Energy Ministerial, June 2002 in Casablanca. Morocco is currently requesting assistance from NREL and DOE in the following areas:

**Electric utility regulatory reform**

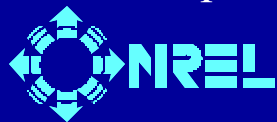
- Including possible privatization of ONE

**Wind energy resource assessment**

- Particularly along the coastline

**Assessment of power export opportunities**

- To Europe and Algeria.





# Algeria – Proposed FY03 Activities

Recent discussions and a visit to DOE from the national energy authority, Sonatrach, has resulted in a request for assistance from NREL and DOE in the following areas:

## **Electric utility regulatory reform**

- Support for developing a national subsidy program to encourage IPP generation under a new law and structure established for promotion of alternative energy technologies

## **Assessment of power export opportunities**

- To Europe and Morocco. Focus on CSP power options.



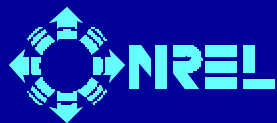
# Ghana –FY02 Activities

## Technology Needs Assessment Support

- Technical support on behalf of CTI
- Technologies under consideration:
  - efficient lighting devices,
  - PV and other renewable technologies for rural applications,
  - grid-connected wind,
  - bio-diesel from the jatropha plant,
  - methane capture from landfills.
- Ghana Needs Assessment work shared with other countries as a model of this process

## RESPRO Rural Electrification Project (pre- FY02)

- Supported development of a UNDP-GEF rural electrification project for past 6 years
- Piloted business model for providing energy services in rural area.
- Ghana appears ready to build on this experience.



# Ghana – Proposed FY03 Activities

## Rural Renewable Applications

Develop a strategy for creating a sustainable rural energy business services, including

- A regulatory framework to support energy service providers and financial assistance;
- Institutional, organizational, information and technical support for rural energy providers
- Ongoing feedback, and problem-solving
- Renewable resource assessment to fill gaps, particularly for wind and small-scale biomass energy technologies

## Efficient Lighting

Build on past effort in the following areas

- Provide technical and business matchmaking support for testing of currently available CFLs and other devices, to devise hardware and business approaches appropriate to conditions in Ghana
- Develop a program for promoting CFLs and other efficient lighting equipment in collaboration with Ghana partners
- Develop and test a business model through which small and micro businesses can participate in the dissemination of efficient lighting equipment in Ghana.



# Egypt –FY02 Activities

(Supported by AID and pre-FY02 EERE Funds)

## Climate Technology

- Obtained agreement of Egyptian General Petroleum Company, operator of refineries to pursue refinery retrofit at one of their facilities
- Recruited and developed Egyptian ESCO partner, ESCO Misr, for refinery project
- Developed partnership with Nexant/Cairo to provide in-country support

## U.S.-Egypt Science and Technology Joint Board (Part of S&T Agreement)

- Organized workshop on hybrid renewable power systems for desert agriculture
- Generated significant interest among Egyptian government, academic, and U.S. partners



# Egypt – Proposed FY03 Activities

## **Renewable and Hybrid Systems for Agriculture**

- Develop refined economic analysis and demonstration of hybrid renewable power systems for desert agriculture

## **Industrial Energy Efficiency**

- Organize trade missions, reverse trade missions, and other events to facilitate U.S.-Egyptian commercial partnerships in the ESCO area.

## **Large Scale Grid Connected Wind**

- Pursue emerging opportunities based on the following recent developments:
- Danish development agency (DANIDA) installing 40 additional MW at Zafarana wind farm on the Red Sea
- US Export-Import bank interested in details of mixed credit arrangement, to make case for matching those terms
- World bank interested in working with NREL to assess how grid-connected wind fits in Egypt's expansion plan

## **Certification and training collaboration with NREA.**

- New and Renewable Energy Authority expressed interest in this area after seeing CDER in Marrakech.
- Could include a range of certification, training, staff exchanges, and other capacity-building activities.



# Southern Africa – FY02 Activities

## CTIP Southern Africa

- Facilitated solar water heater project in Durban, South Africa and sugar mill cogeneration project in Mauritius with USAID and Japan, a CTI partner.



# Southern Africa – Proposed FY03 Activities

## Promote CTIP Regional Replication and Project Implementation

NREL will work with project stakeholders to promote regional replication of two existing CTIP actions (bagasse cogeneration in Mauritius and solar water heating in South Africa).

- Hold two workshops, one on bagasse cogeneration and another on solar water heating, with project stakeholders from countries where the potential for identifying project opportunities is high and where CTI donors have a strong investment interest.
- Develop summaries of existing Mauritius and South Africa projects to share with regional partners. Work with regional partners to identify countries where opportunities exist to address concrete market barriers and promote investment in bagasse cogeneration and solar water heating.
- Continue technical assistance to projects in Mauritius and South Africa. Assist partners in presenting progress to appropriate climate officials.



## **(Mozambique, Nigeria)**

### **Biomass-based Rural Electrification in Mozambique**

Technical support to Community Power Corporation to deploy a small modular biomass power unit for village electrification using coconut shells

- Successful scoping in 2001 identified project partners and a site for a 5-25 kW demonstration project, and resulted in a complete project concept report;
- World Bank has expressed interest in possible project expansion as part of its on-going rural electrification loan development

### **Strategic Planning in Nigeria**

- Most populous country in Africa with over 123 million people, 60% unelectrified
- Net importer of food with large and immediate need for water pumping & purification, as well as health and other rural services
- Strategic planning activities will help to define and prioritize Nigeria's needs, and capitalize on policy, training, strategic planning and hardware deployment opportunities





# Supporting Activities

- Global Village Energy Partnership
  - Evolving collaboration between AID, WB, UNDP, European bi-laterals, Labs, other stakeholders to improve focus and coordination of programs
- Clean Energy Technology Export Initiative
  - DOE, AID, Commerce and other USG agencies (awaiting funding and HQ direction)
- Climate Technology Initiative (support USG involvement)
- S&T Agreements
- Project Analysis Tools (integration of RE performance assessment with high resolution GIS mapping)
- RE Training Materials and Courses
- UNEP Collaborating Center & SWERA Project



# Industry Applications Development Initiative

(Help fill the Gap between Component Realities and Market Requirements)

- Field deployment and maintenance problems can be reduced through better systems integration, packaging, and testing of applications-specific RE systems.
- The market potential for RE technologies can be expanded by focusing on value-added products and services.

Barriers to the development of RE applications for the developing world.

- Product development costs (lack of research program support)
- Prototype testing and redesign, field testing and redesign
- Marketing and distribution

**Target Applications** include, but are limited to:

- Water -- pumping, purification, desalination and waste water treatment
- Agriculture -- crop drying, refrigeration, juicing, and other post-harvest processing
- Bioenergy for village power, small cogeneration, and home fuel needs
- Income-generating productive uses such as sewing and carpentry
- Community-scale ice making and refrigeration

NREL recommends that DOE launch a technology-neutral applications development initiative through a competitive procurement focused on productive use applications.



# EERE's Tribal Energy Program

- Financial and Technical Assistance to Tribes for Feasibility Studies and Share the Cost of Implementing Sustainable Renewable Energy Installations on Tribal Lands
- Promoting Tribal Energy Self-Sufficiency and Fostering Employment and Economic Development on Tribal Lands

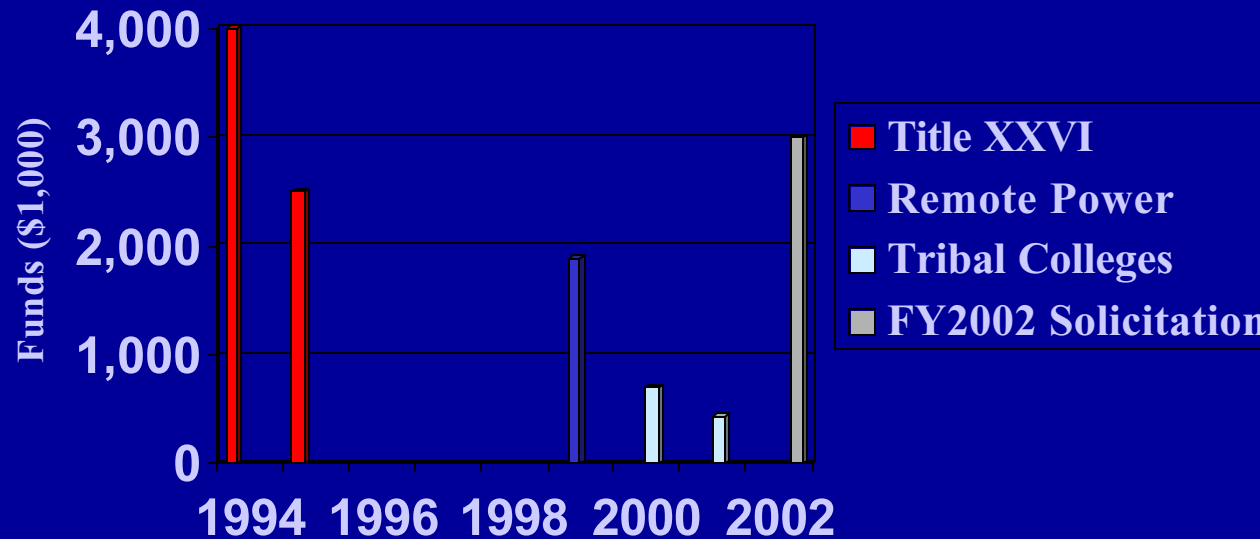


# EERE's Tribal Energy Program

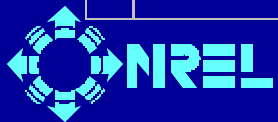
- **Developed In Consultation with Tribes**
  - Peer Review (November 2001)
  - Strategy Sessions (December 2001, 2002)
- **Providing Financial Assistance to Tribes**
  - Competitive Solicitations
- **Providing Resources and Support for Renewable Energy Projects**
  - Technical Support
  - Tribal Energy Program Website
- **Supporting Government-to-Government Relations**



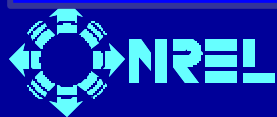
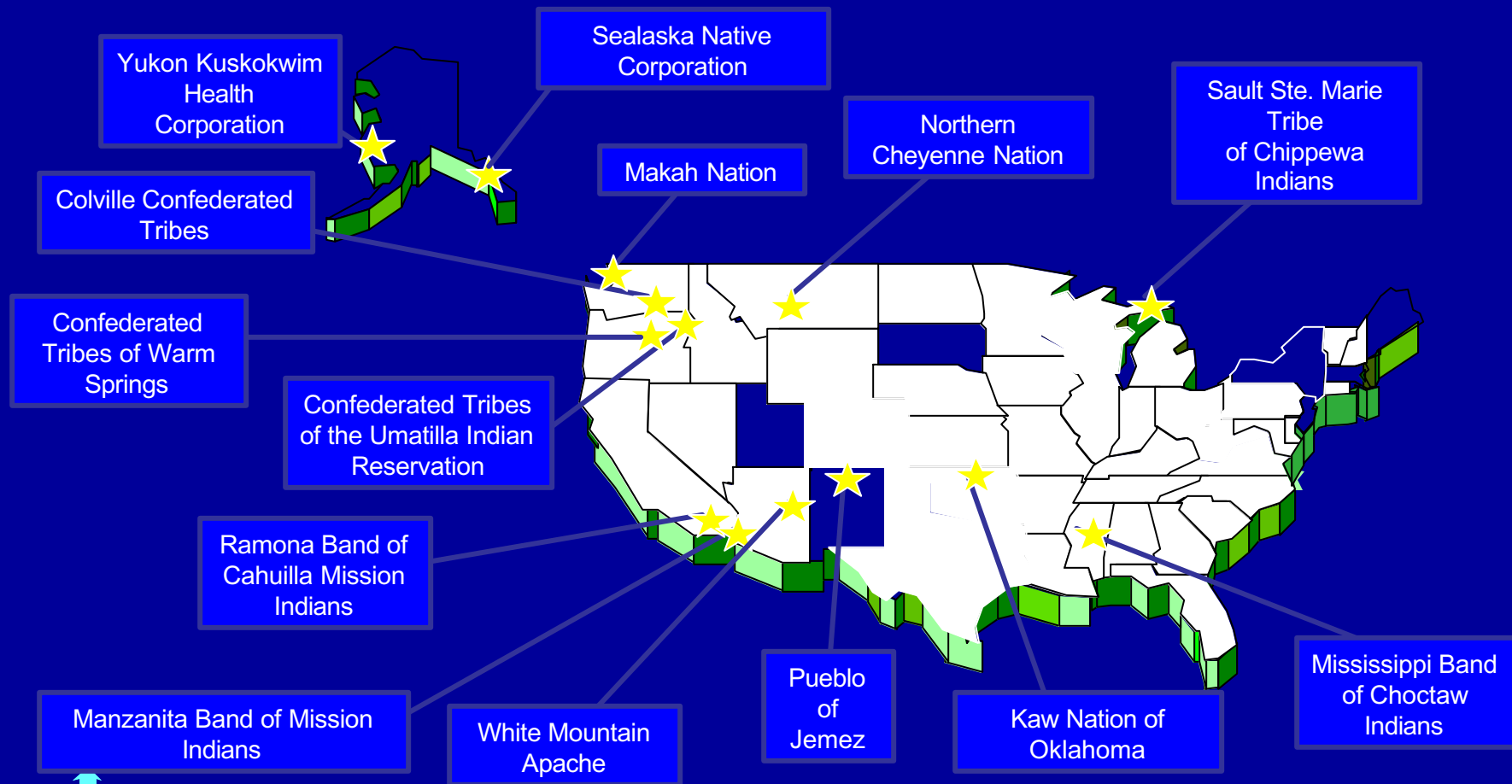
# TRIBAL ENERGY PROGRAM FUNDING



PROGRAMS	1994	1995	1999	2000	2001	2002
Title XXVI	4,000	2,500				
Remote Power			1,900			
Tribal Colleges				700	430	
FY 2002 Solicitation						3,000



# U.S. Department of Energy Funds Renewable Energy Development on Tribal Lands



# EERE's Tribal Energy Program

**Program Management through DOE Headquarters,  
program implementation through the DOE Golden Field  
Office, and technical support through the DOE's  
Laboratories.**

